

HOT TOPICS IN CARDIOLOGIA 2021

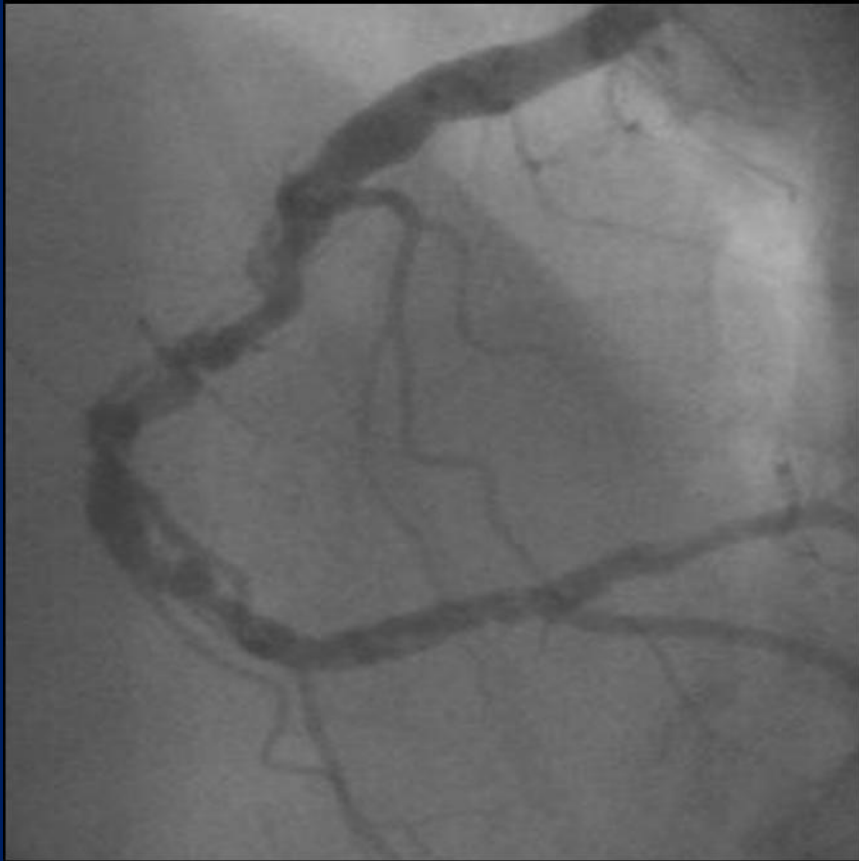
27 e 28 Settembre

Sede della Camera di Commercio di Napoli

Imaging Intracoronarico: Vantaggi e Limiti

Dr. Marco Boccalatte
Ospedale Santa Maria Delle Grazie
Pozzuoli







1995 !

ARTICLE

Intracoronary Stenting Without Anticoagulation Accomplished With Intravascular Ultrasound Guidance

Antonio Colombo, Patrick Hall, Shigeru Nakamura, Yaron Almagor, Luigi Maiello, Giovanni Martini, Antonio Gaglione, Steven L. Goldberg, and Jonathan M. Tobis

ABSTRACT: *Background* The placement of stents in coronary reduce restenosis in comparison to balloon angioplasty. However, stents is impeded by the risk of subacute stent thrombosis and the anticoagulant regimen. To reduce these complications, anticoagulation is not necessary when adequate stent

prospectively evaluated on a consecutive series of patients who

Figure 2. Flow diagram depicting angiographic findings in unsuccessful stent implantation procedures associated with major events.

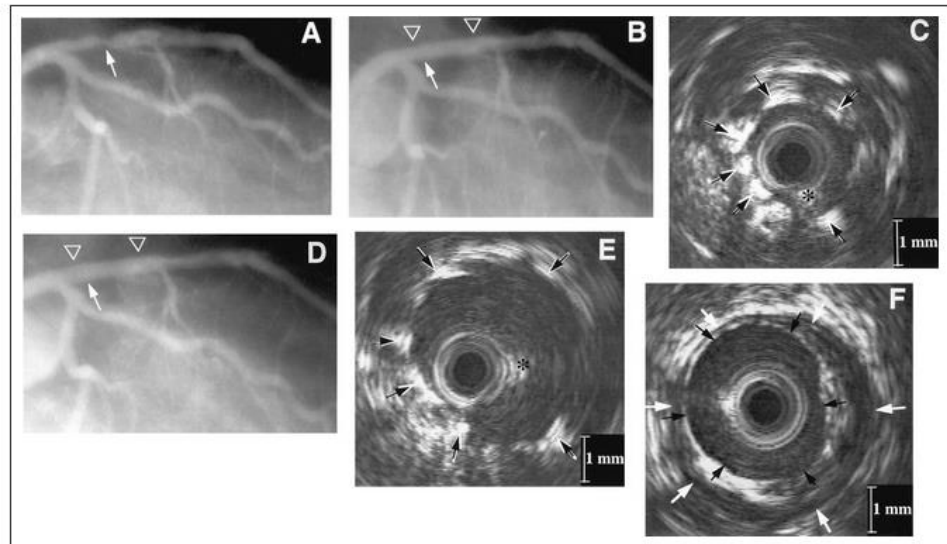
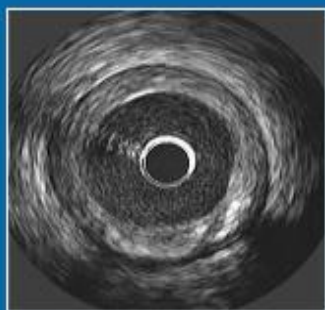
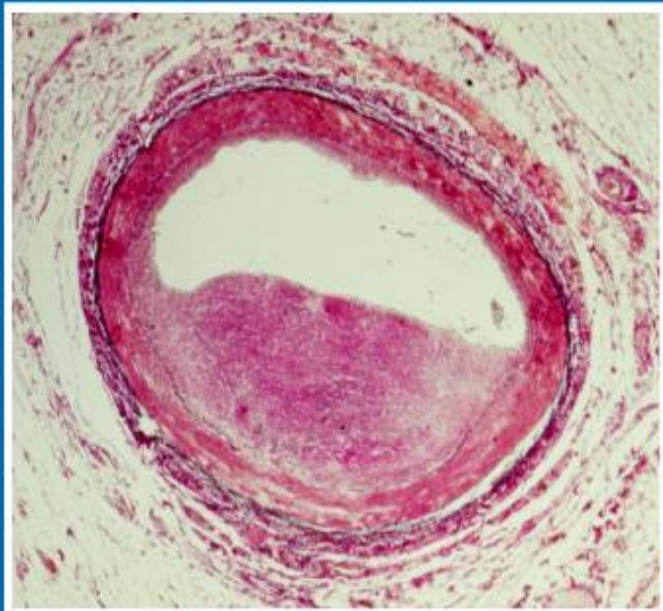
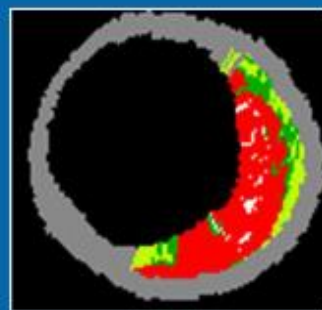


Figure 3. Example of intravascular ultrasound-guided coronary stent implantation. A, Baseline angiogram.

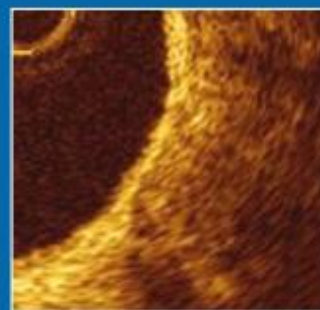
Expanding World of Invasive Plaque Imaging



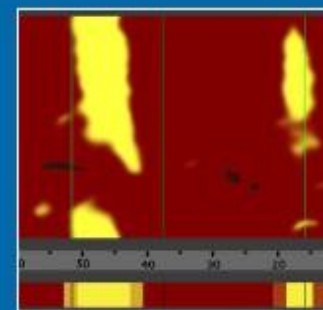
IVUS



IVUS-VH



OCT



NIR Spectroscopy

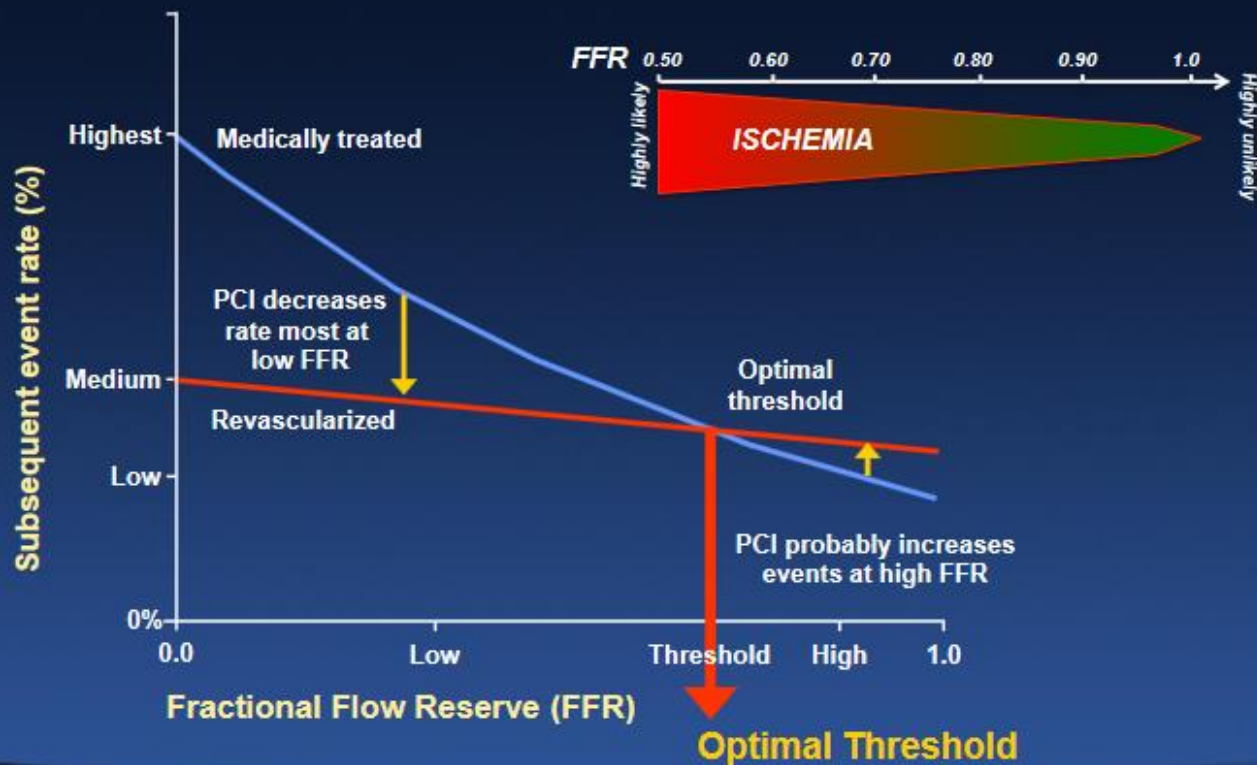
Modalities

- **FFR**
- **iFR (and other resting indices)**
- **IVUS**
- **RF-IVUS (VH-IVUS, iMAP, or IB-IVUS)**
- **OCT**
- **NIRS**
- **Some combination of the above**

Clinical questions

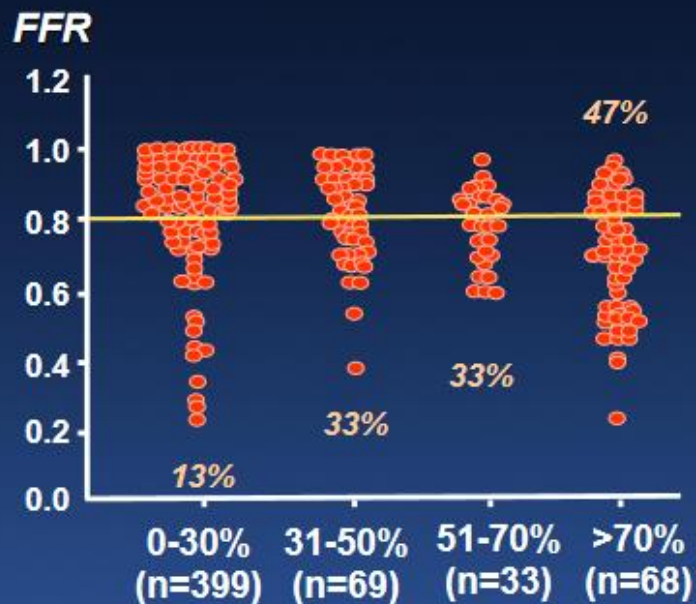
- **Is this lesion flow-limiting?**
 - **Non-LMCA**
 - **LMCA**
- **Pre-intervention lesion assessment (ie., what is the culprit?)**
- **Is this “other” lesion a vulnerable plaque that is at risk for future events?**
- **What is the likelihood of embolization during stent implantation?**
- **How do I effectively treat an CTO?**
- **How do I guide and optimize acute stent results (size, length, expansion, edge coverage)?**
 - **Is this jailed sidebranch significant?**
- **Why did this stent thrombose or restenose?**

FFR as Continuous Marker of Risk

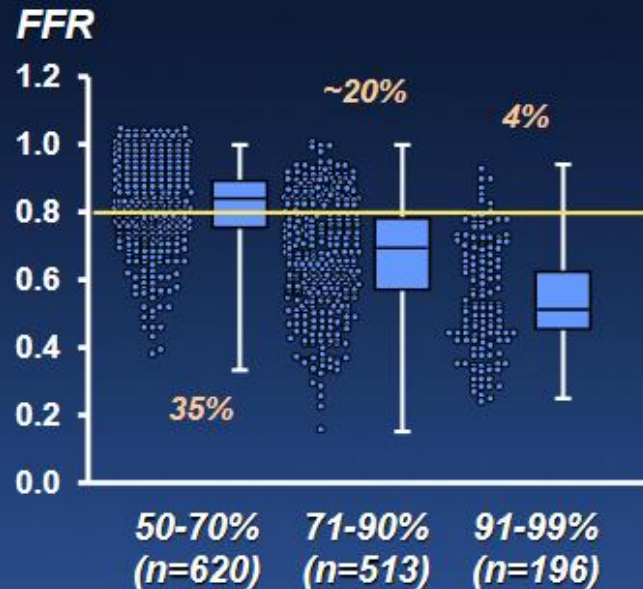


FFR as Continuous Marker of Risk: Meta-analysis

FFR vs Angiography: Analysis from RIPCORD



FFR vs Angiography: Analysis from FAME-I



Stenosis severity by angiography (visual estimation)

Deferral of revascularization in the pooled per-protocol population (n=4,486) of the DEFINE-FLAIR and iFR-SWEDEHEART randomized clinical trials comparing SAP vs ACS

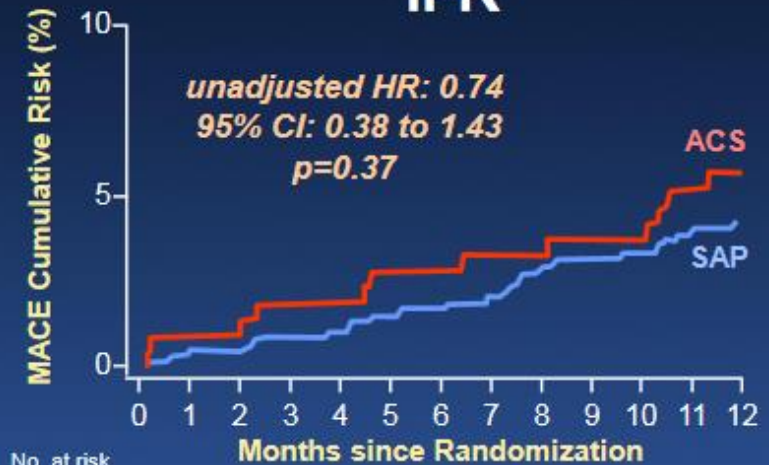
FFR



No. at risk

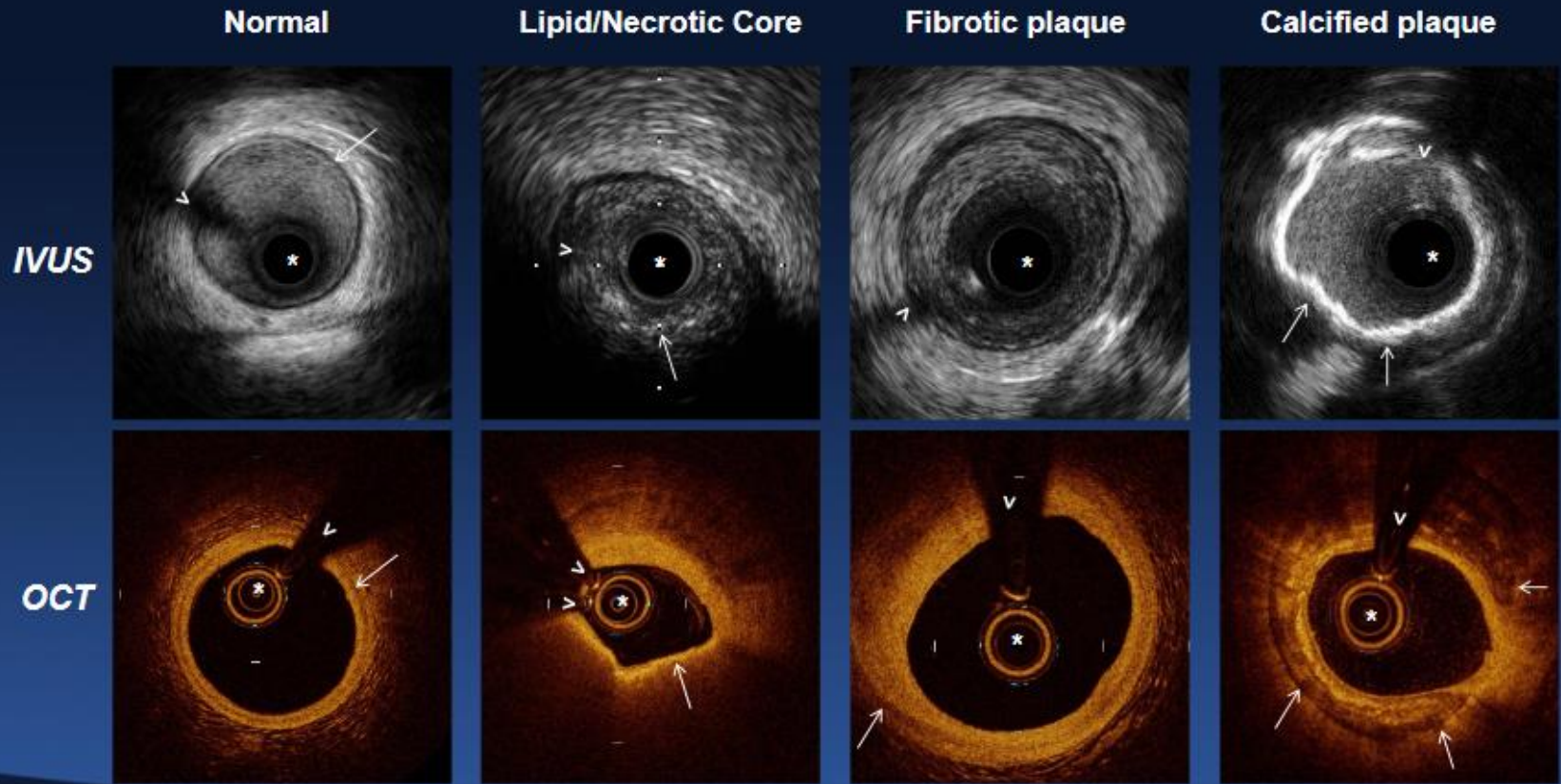
ACS	218	213	212	212	210	208	207	205	201	199	198	196	183
SAP	790	764	756	752	749	749	738	725	718	711	708	693	617

iFR

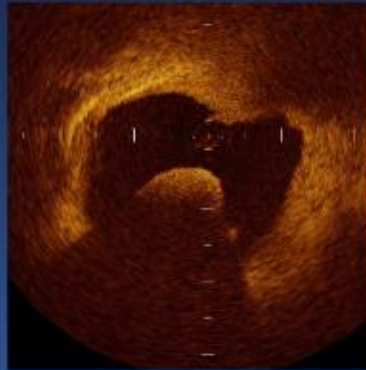


No. at risk

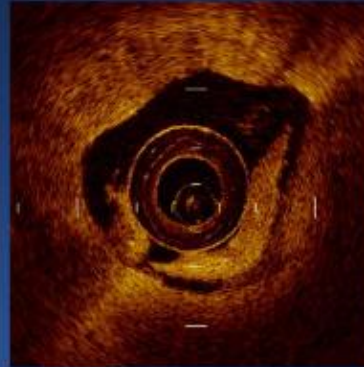
ACS	222	217	216	215	215	212	211	208	208	207	207	204	188
SAP	885	851	847	841	840	834	821	798	790	783	779	768	689



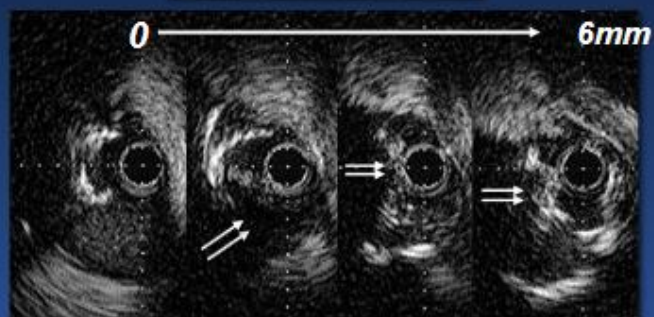
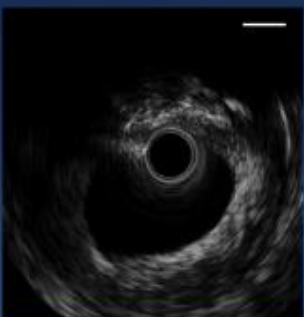
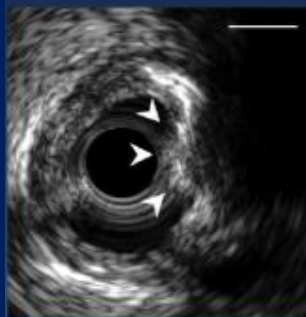
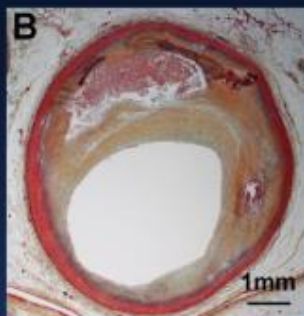
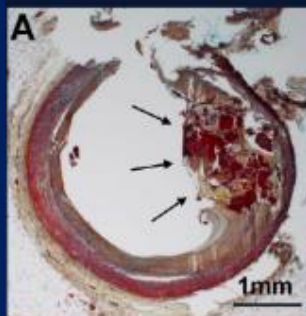
Red thrombus



White thrombus



Calcific Nodules

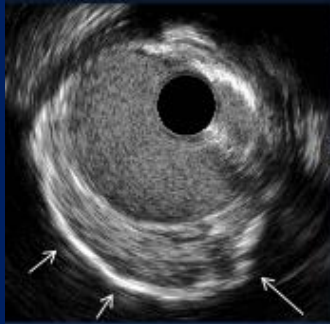


Dussailant et al. *Am Heart J* 1996;132: 687-9

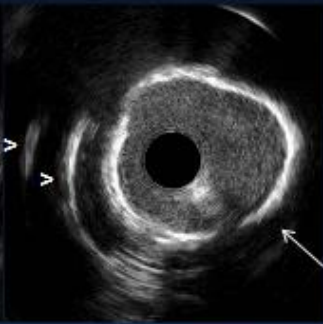
Lee et al. *Am J Cardiol* 2011;108:1547-51

Jia et al. *J Am Coll Cardiol* 2013;62:1748-58

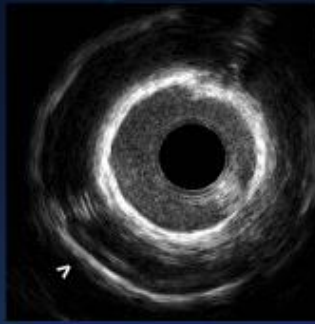
Deep calcium



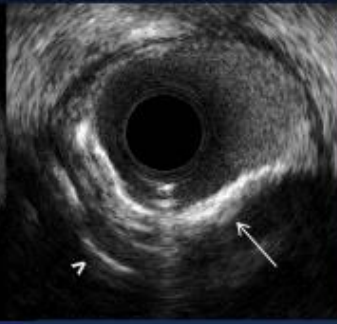
Superficial calcium



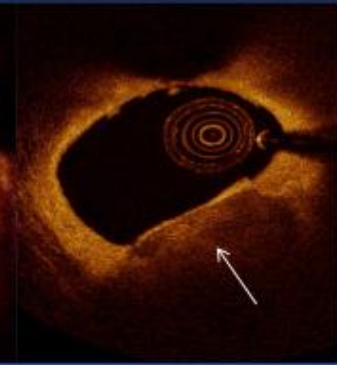
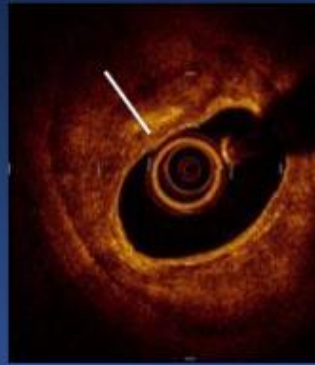
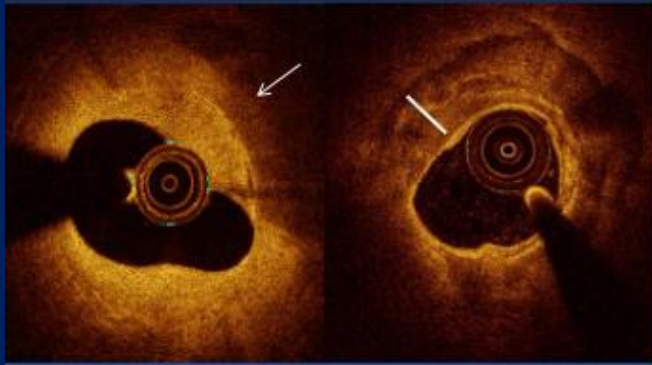
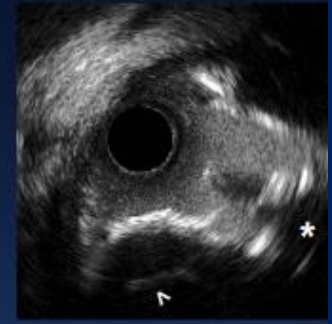
Concentric calcium



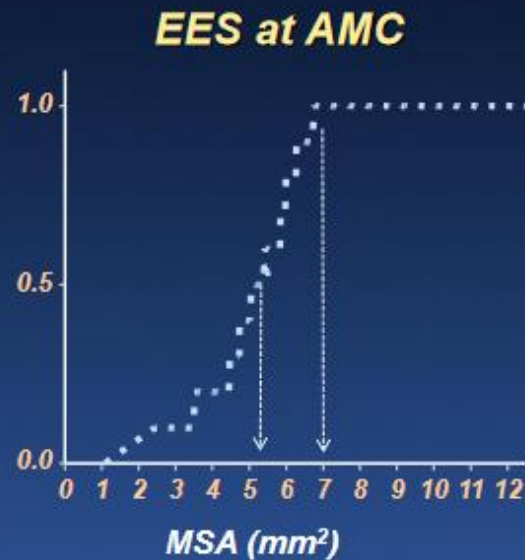
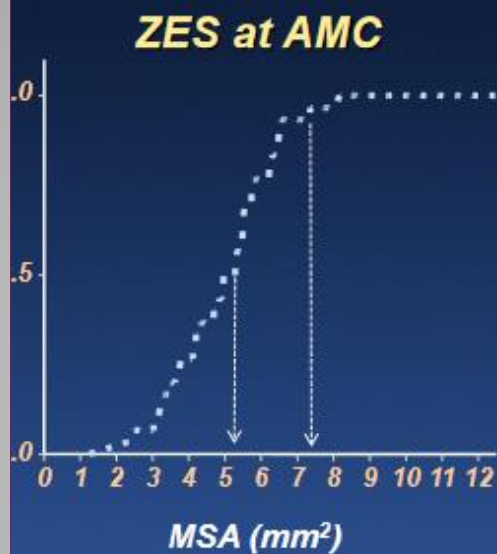
Eccentric calcium



Calcified nodule

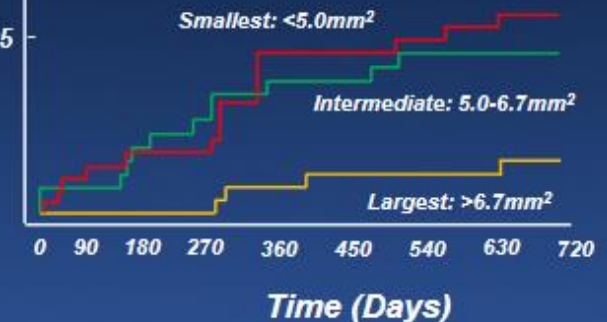


Predicting Freedom From Angiographic Restenosis with Second Generation DES



Cumulative incidence of TLR (%) in SYNTAX II by MSA Tertiles

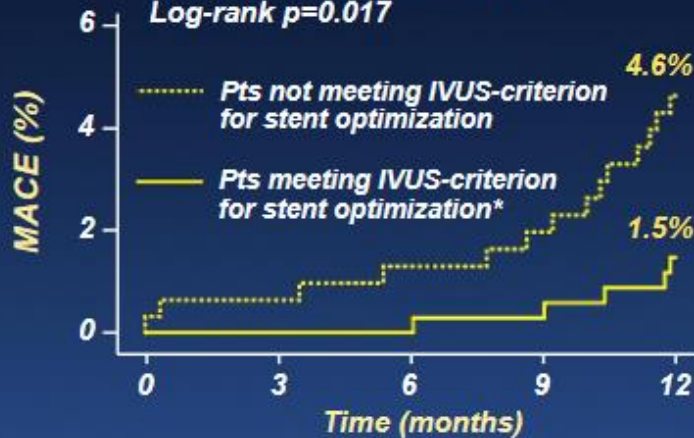
$P=0.042$



Effect of IVUS Optimization

IVUS-XPL

HR, 0.31 (95% CI, 0.11-0.86)
Log-rank p=0.017

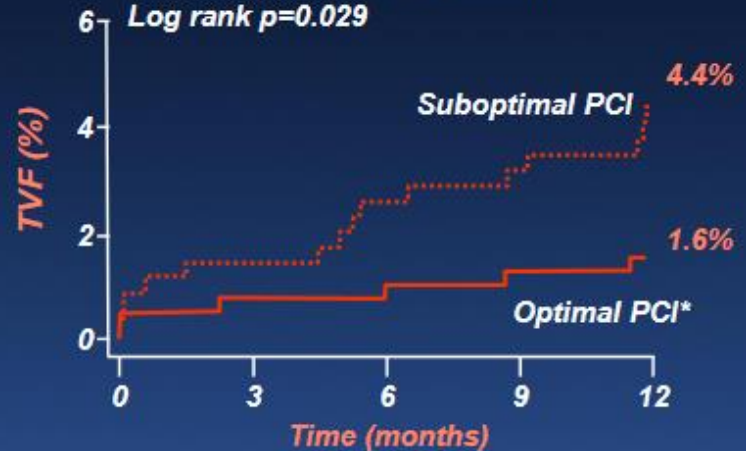


	No. at risk				
No stent optimization	315	299	297	394	285
Stent optimization	363	362	345	338	334

*In-stent MLA >distal reference

ULTIMATE

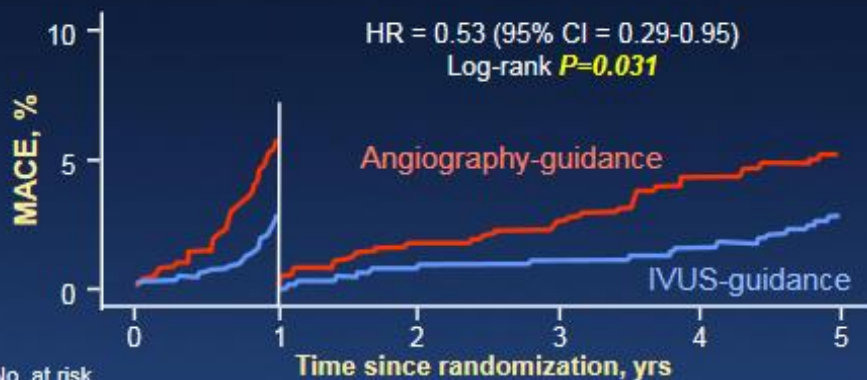
HR: 0.35 (95% CI: 0.135-0.898);
Log rank p=0.029



	No. at risk				
Suboptimal PCI	340	334	329	326	320
Optimal PCI	384	381	381	378	376

*In-stent MLA >5.0 mm² or >90% of distal reference lumen
Edge plaque burden <50% with no medial dissection

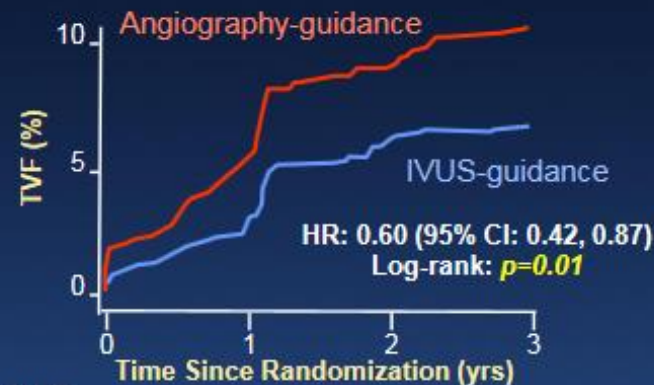
IVUS-XPL: Five year follow-up



No. at risk		0	1	2	3	4	5
Angiography arm	700	624	603	586	562	543	
IVUS arm	700	641	624	609	591	562	

Hong et al. JACC Cardiovasc Interv 2020;13:67-71

ULTIMATE: Three year follow-up



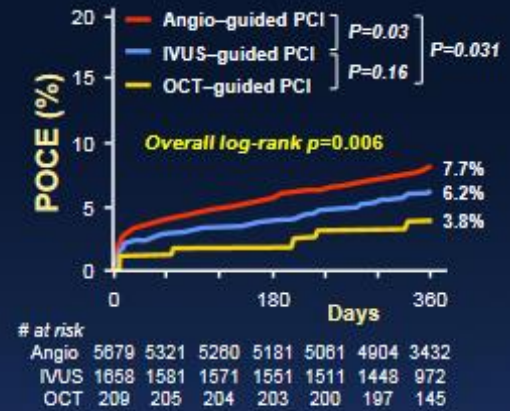
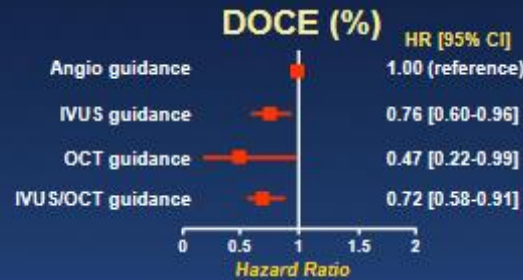
No. at risk		0	1	2	3
Angiography	724	698	676	651	643
IVUS	724	710	696	676	660

Gao et al. JACC Cardiovasc Interv 2021;14:247-57

IVUS and OCT-guided primary PCI in the KAMIR Registry

- KAMIR (Korean AMI Registry) is an online, open-label registry at 20 sites that was established in 2011 with the help of the Korean NIH
- From 11/2011 to 12/2015, 11,731 STEMI pts underwent 1° PCI: 9072 with angio-guidance and 2333 with IVUS and 277 with OCT to optimize stent expansion, apposition, and lesion coverage.

In the propensity-score matched cohort, difference in POCE was mainly driven by reduced all-cause mortality with IVUS (4.9% vs. 7.0%; log-rank $p=0.002$) and OCT (1.9% vs. 7.0%; log-rank $p=0.004$). The difference in DOCE was mainly driven by reduced cardiac mortality in IVUS (3.6% vs. 5.2%; log-rank $p=0.009$) and OCT-guided PCI (1.4 vs. 5.2%; log-rank $p=0.014$).

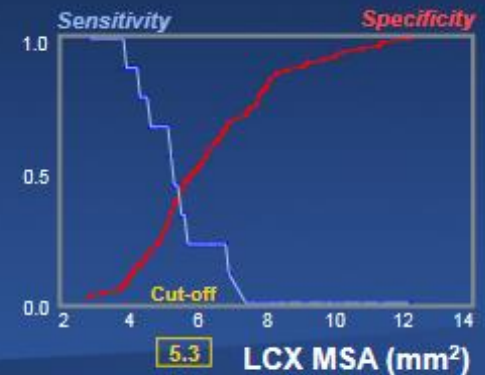
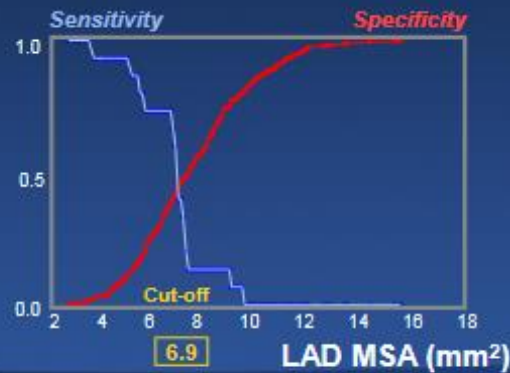
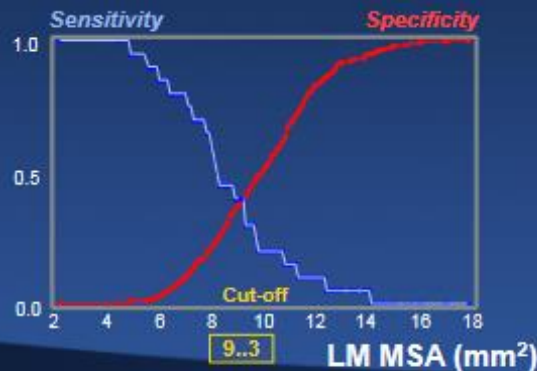


EXCEL: MSA to Predict LMCA-Related Events



Number at risk:	0	1	2	3
MSA < 9.3	202	179	165	140
MSA ≥ 9.3	303	282	268	238

	Adjusted Hazard Ratio (95% CI)	P-value
Final IVUS LM MSA (mm²)	0.84 (0.75-0.94)	0.003
Distal LM lesion location	1.73 (0.78-3.87)	0.18
Diabetes mellitus	1.68 (0.97-2.91)	0.09
Stable presentation	1.57 (0.90-2.73)	0.11
Male sex	0.68 (0.38-1.20)	0.18

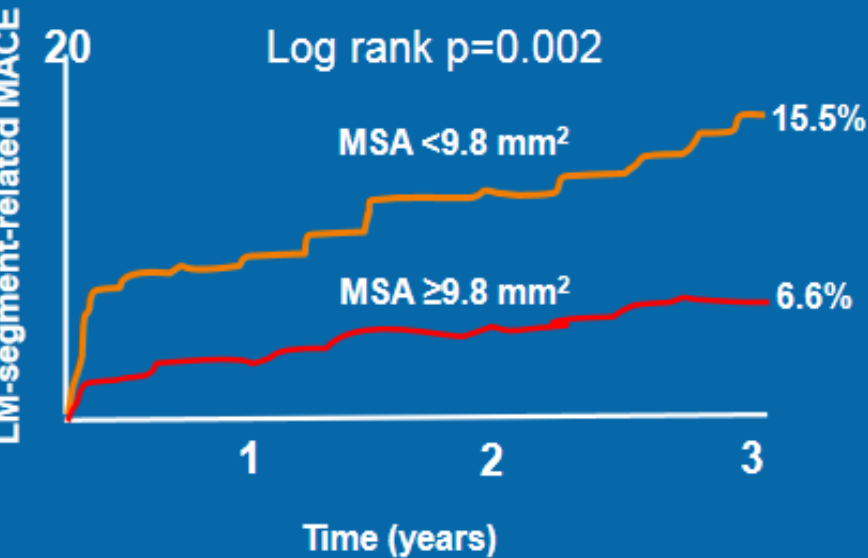


Stent Expansion Criteria (LM lesions)

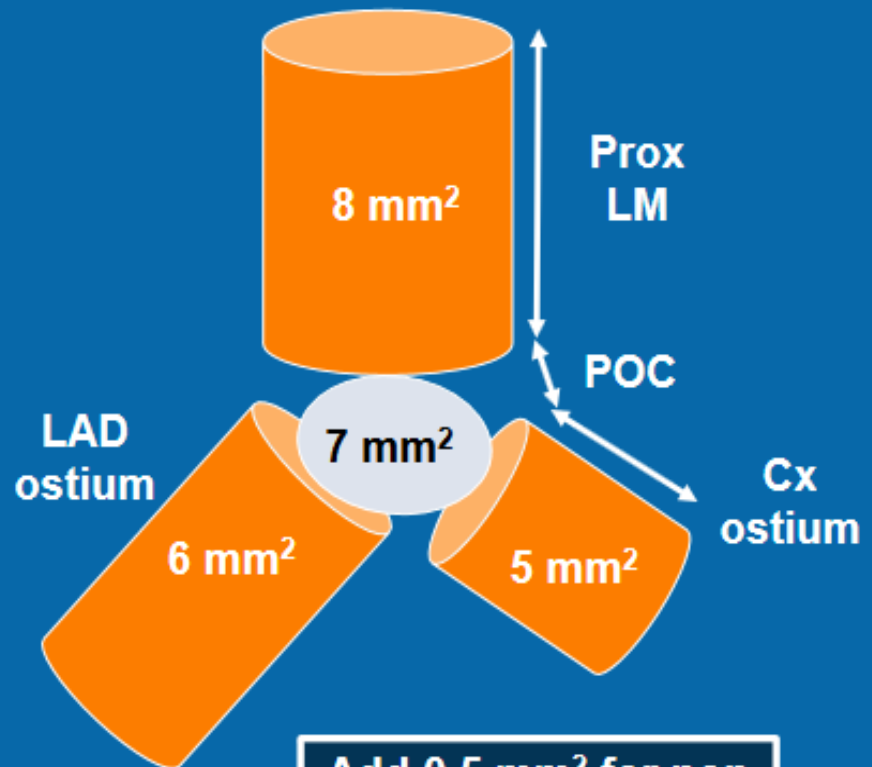
EXCEL trial

1905 with unprotected LMCAD
randomized to CABG vs. PCI

IVUS Substudy (n=504)



Unpublished, slide adopted from Gary Mintz



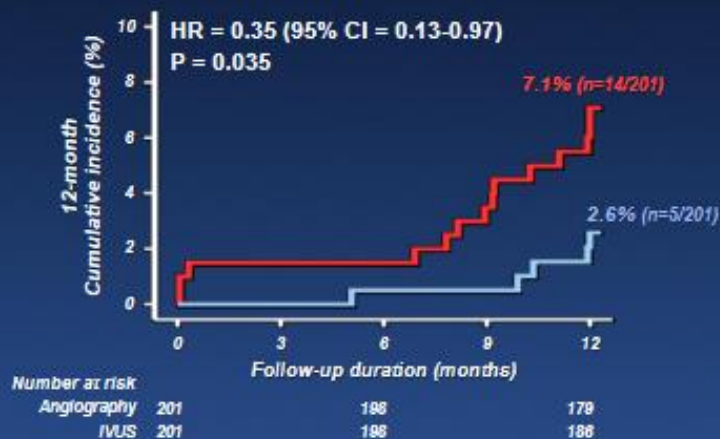
Add 0.5 mm² for non
Asian or larger BSA
patients

Randomized IVUS vs Angiographic Guided CTO Intervention

Primary endpoint (Cardiac death, MI, TVR)

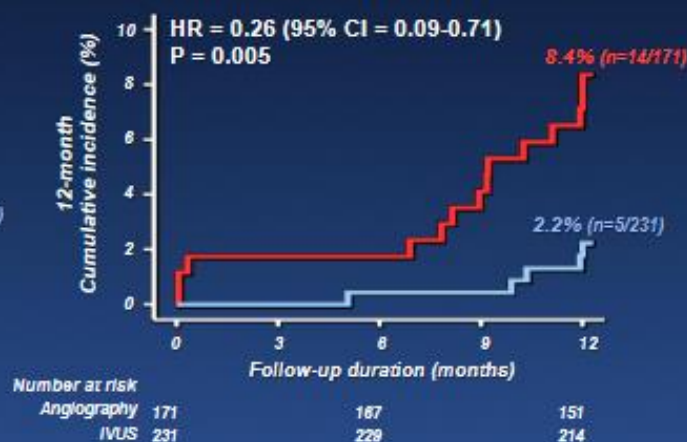
— Angiography-guided group
— IVUS-guided group

Intention to Treat



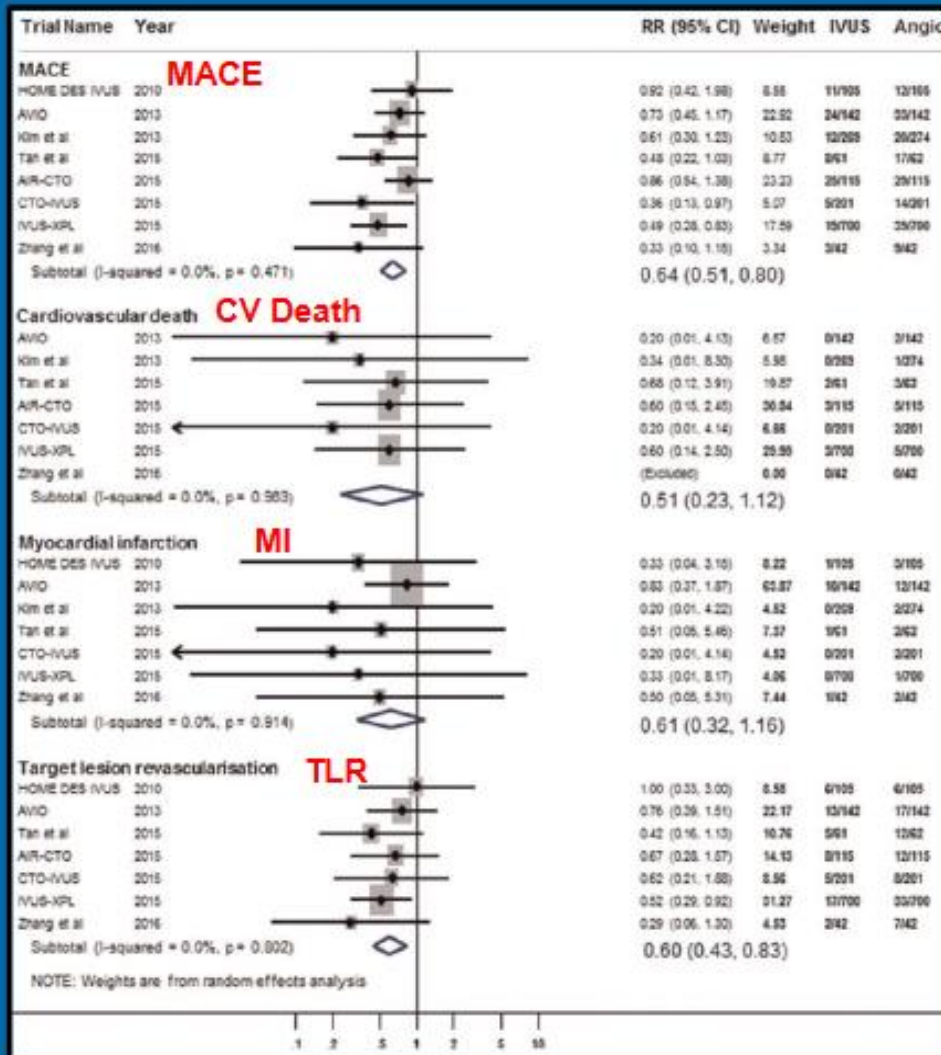
	IVUS	Angio	P-value
Cardiac death/MI	0%	2%	0.045
TVR	2.6%	5.2%	0.186

Per Protocol
(30 pt x-over from angio to IVUS-guidance)



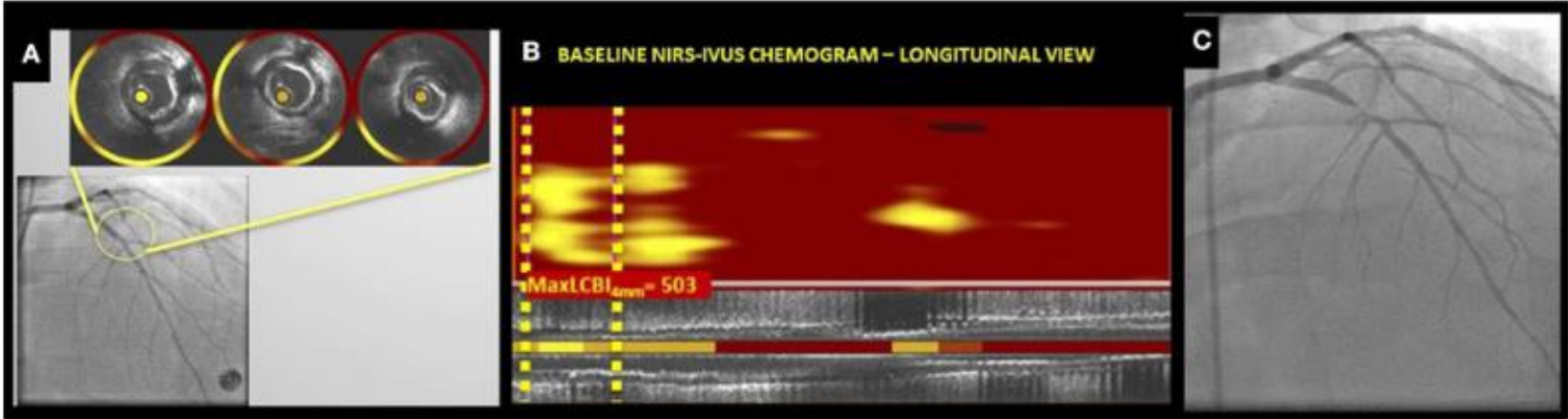
	IVUS	Angio	P-value
Cardiac death/MI	0%	2.3%	0.019
TVR	2.2%	6.1%	0.049

IVUS-GUIDED PCI: META-ANALYSIS

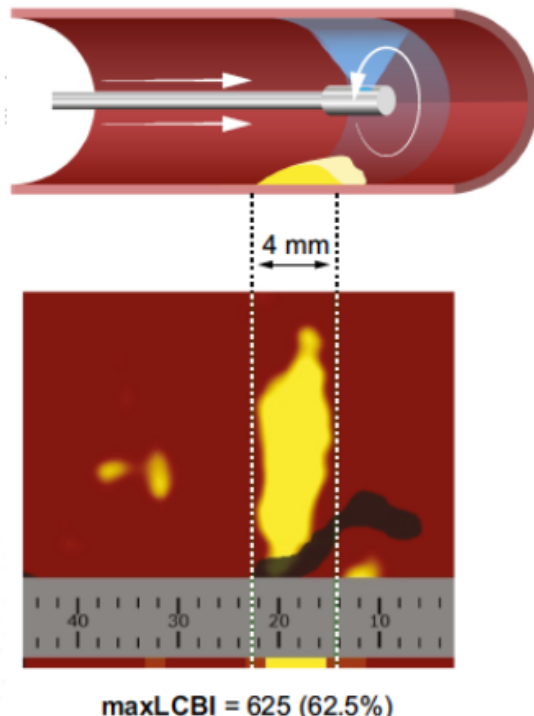




NIRS IVUS + scansione Infrarossi

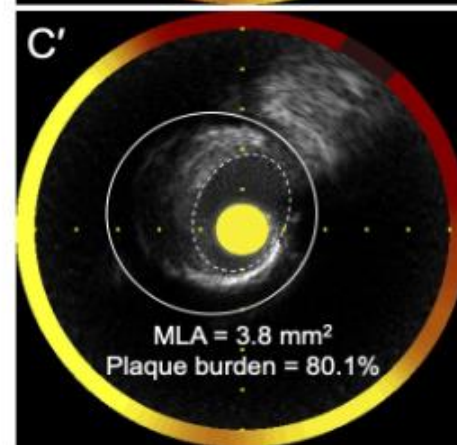
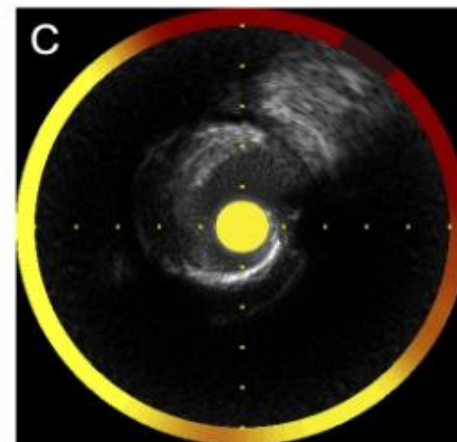
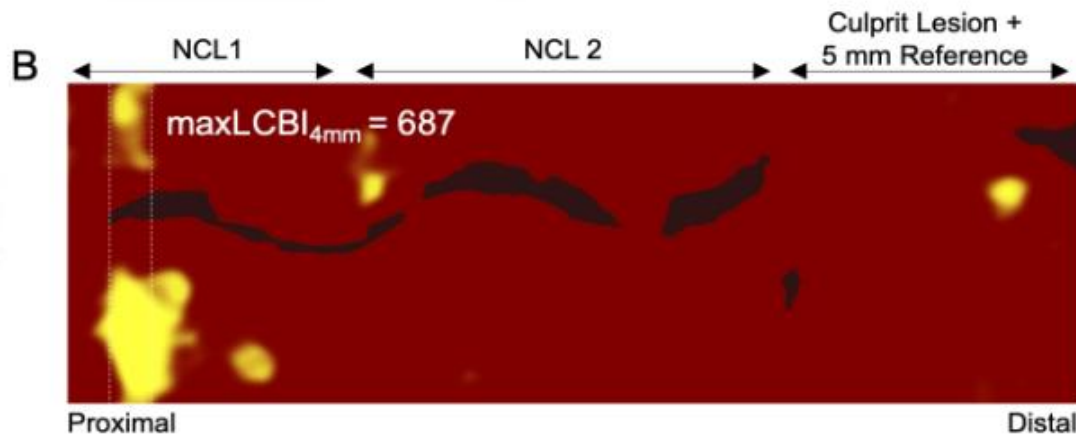
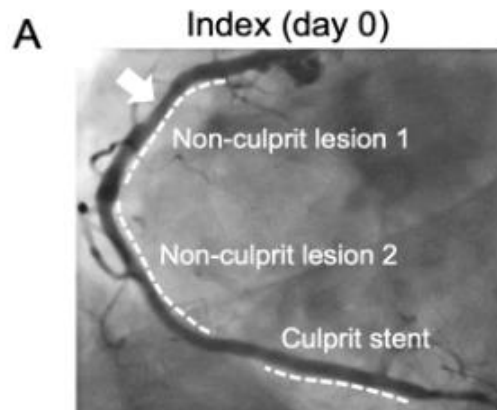


Imaging Analysis: NIRS

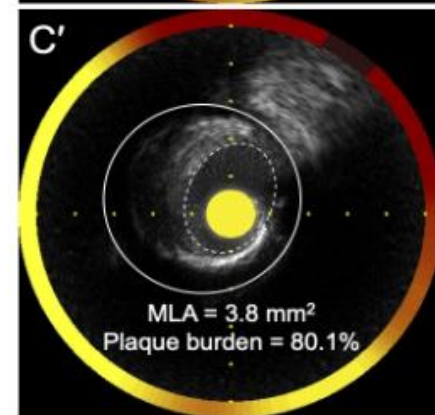
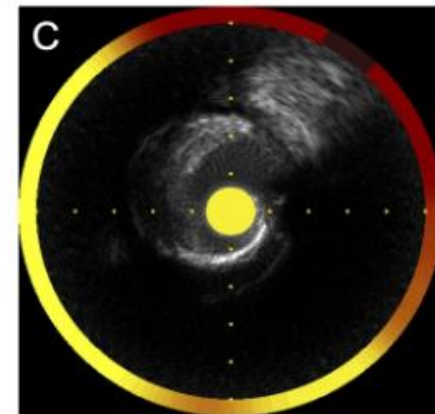
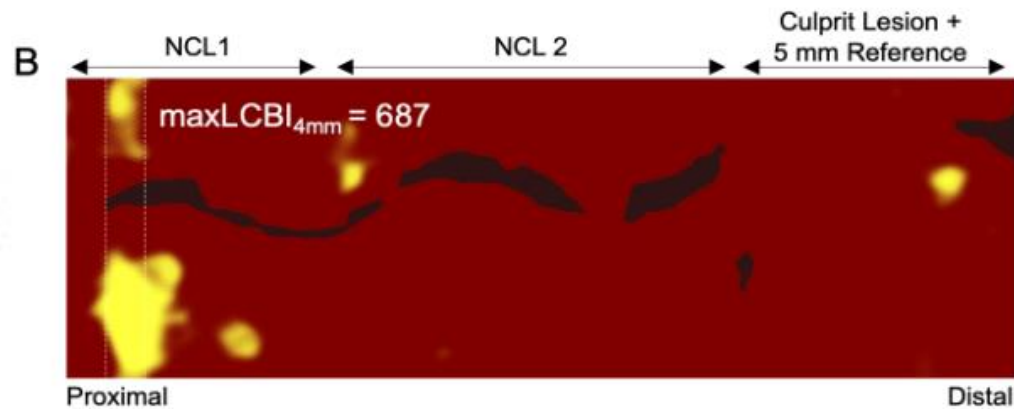
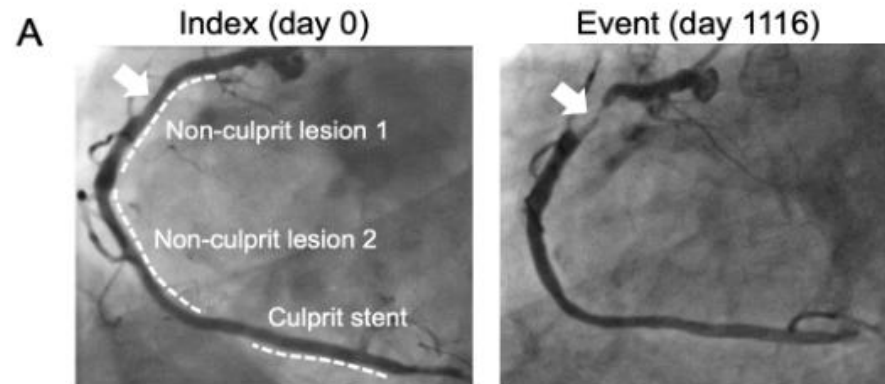


- NIRS spectroscopic data generates a chemogram, a color-coded distribution of lipid probability with the x-axis corresponding to the axial vessel position (0.1 mm/pixel) and the y-axis corresponding to the circumferential position (1°/pixel)
- Low probability of lipid is shown as red and high probability of lipid is shown as yellow
- Lipid core burden index (LCBI) = the fraction of pixels with probability of lipid >0.6 divided by all analyzable pixels within the region of interest, multiplied by 1000
- $\text{MaxLCBI}_{4\text{mm}}$ = the maximum LCBI within any 4 mm segment across the entire lesion

An adverse event attributed to an untreated NCL

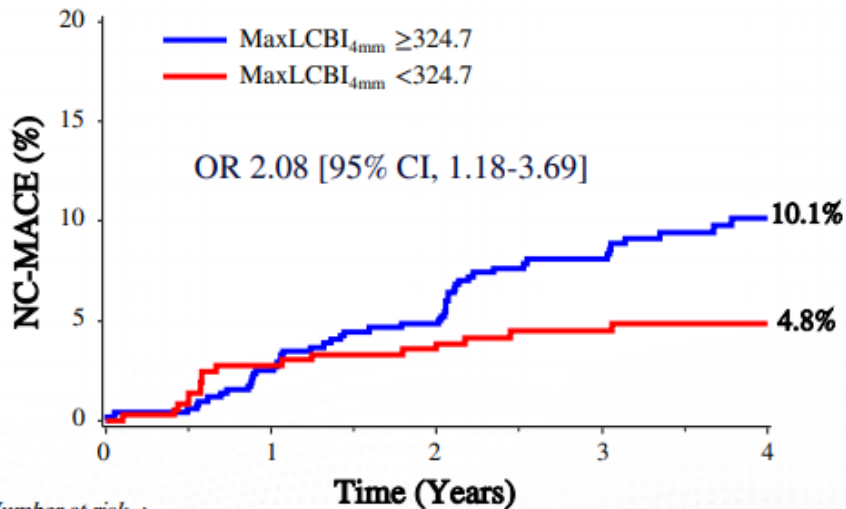


An adverse event attributed to an untreated NCL

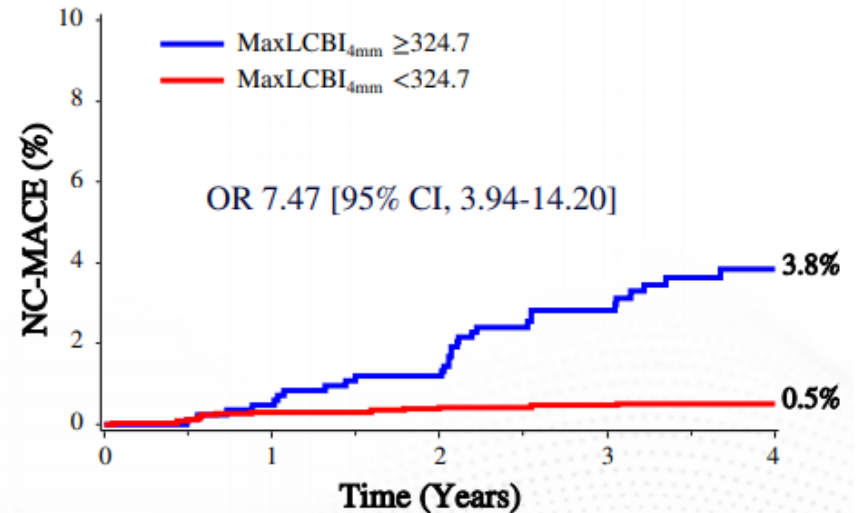


NCL-related MACE According to the Presence of HR Plaque Defined by **Upper Quartile MaxLCBI_{4mm}**

Patient-level events



Lesion-level events

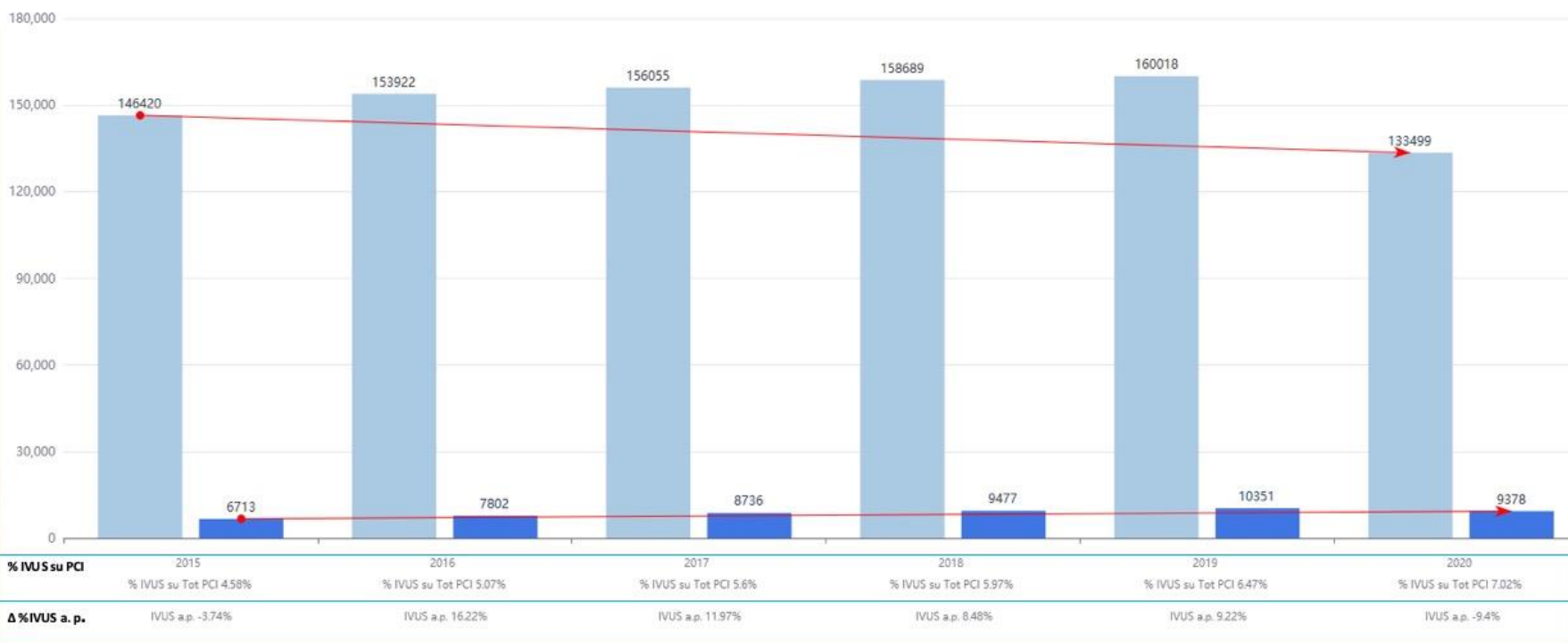


Number at risk :

	0	1	2	3	4	0	1	2	3	4
≥324.7	520	503	490	359	202	851	837	830	621	359
<324.7	364	352	345	255	127	2,649	2,623	2,610	1,976	1,092

Procedure con IVUS su PCI

Serie storica Italia

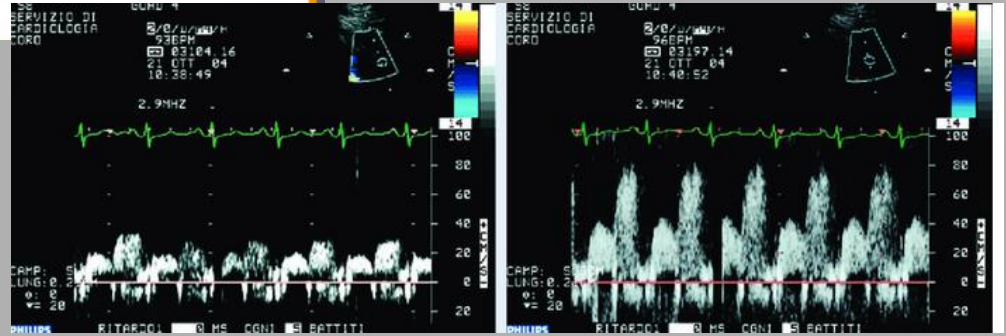
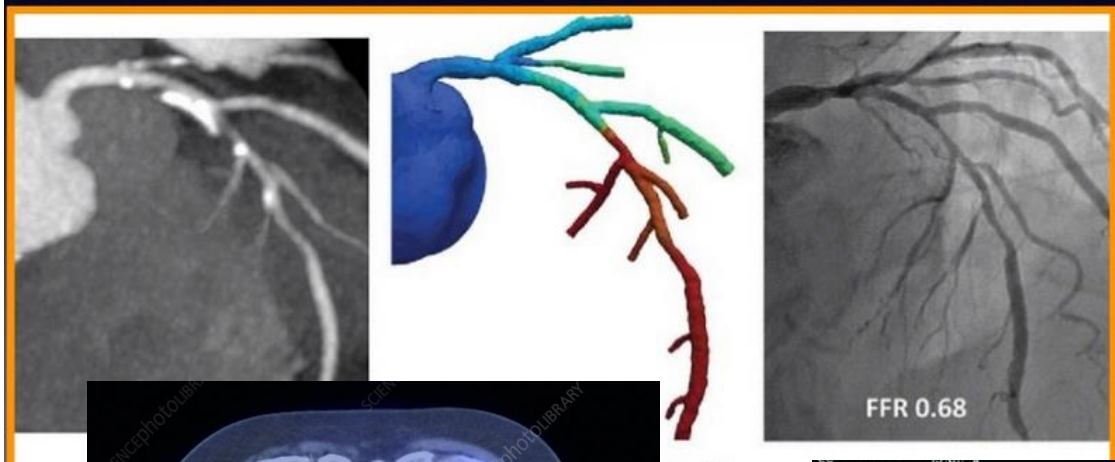
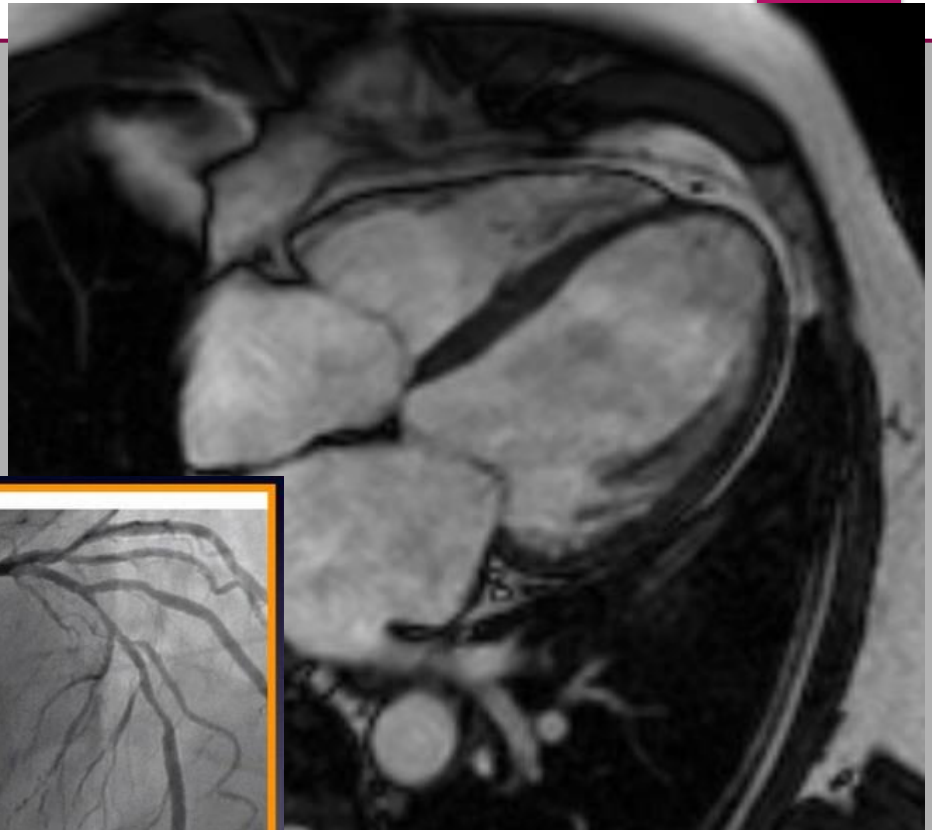
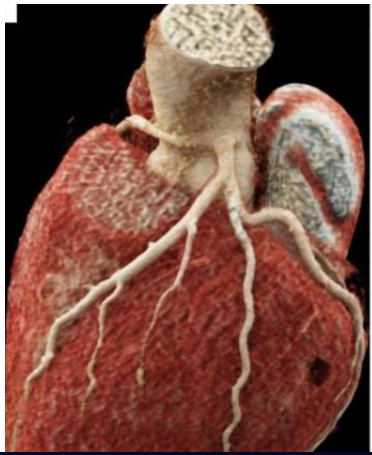




ALBA di una Nuova ERA

CONSAPEVOLEZZA







Grazie a tutti Voi









Grazie







IL MONDO CHE CAMBIA



VIA LATTEA

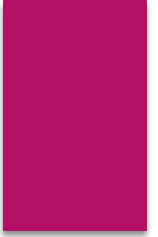
NON SIAMO SOLI NELL'UNIVERSO. UNO STUDIO LO CONFERMA

IVUS vs. OCT

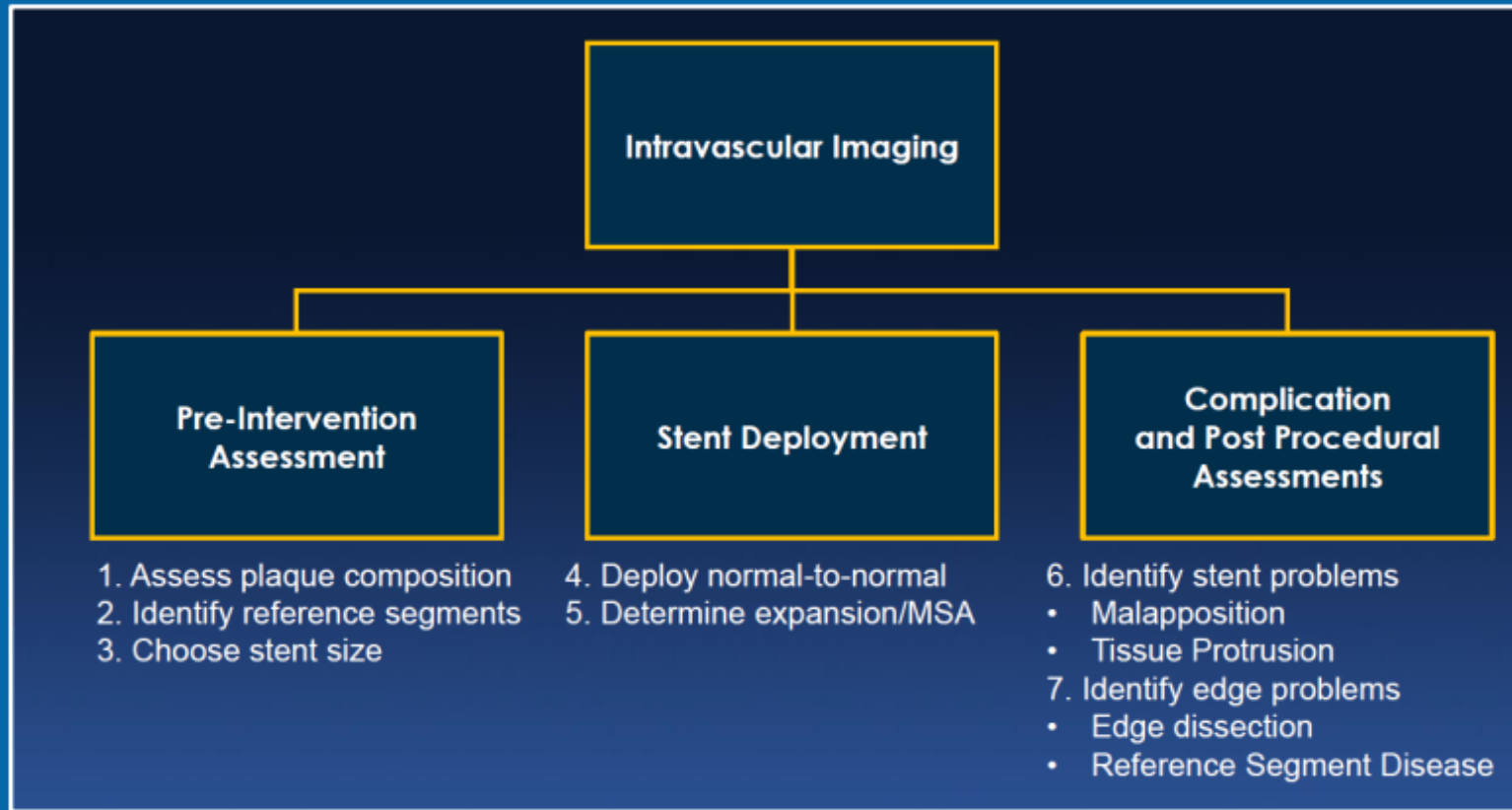
CENTRAL ILLUSTRATION: IVUS and OCT: Similarities and Differences

OCT				IVUS		
Very good	Good	Feasible		Feasible	Good	Very good
			Pre-PCI			
●	●	●	Severity of calcium	●	●	
		●	Prediction of slow flow	●		
	●	●	Stent sizing by vessel wall	●	●	●
●	●	●	Stent length to cover normal to normal	●	●	●
			Post-PCI			
●	●	●	Stent expansion	●	●	●
●	●	●	Tissue protrusion through strut	●	●	
●	●	●	Stent malapposition	●	●	
	●	●	Stent deformation (frequently at aorto-ostium)	●	●	
●	●	●	Stent edge dissection	●	●	
●	●	●	Residual disease at stent edge	●	●	●
			Follow-up			
●	●	●	Old stent expansion	●	●	●
	●	●	Tissue coverage	●		
●	●	●	Neointimal hyperplasia	●	●	●
	●	●	Stent fracture	●	●	
●	●	●	Stent malapposition	●	●	
		●	Positive remodeling of vessel wall	●	●	●
●	●	●	Neoatherosclerosis	●	●	

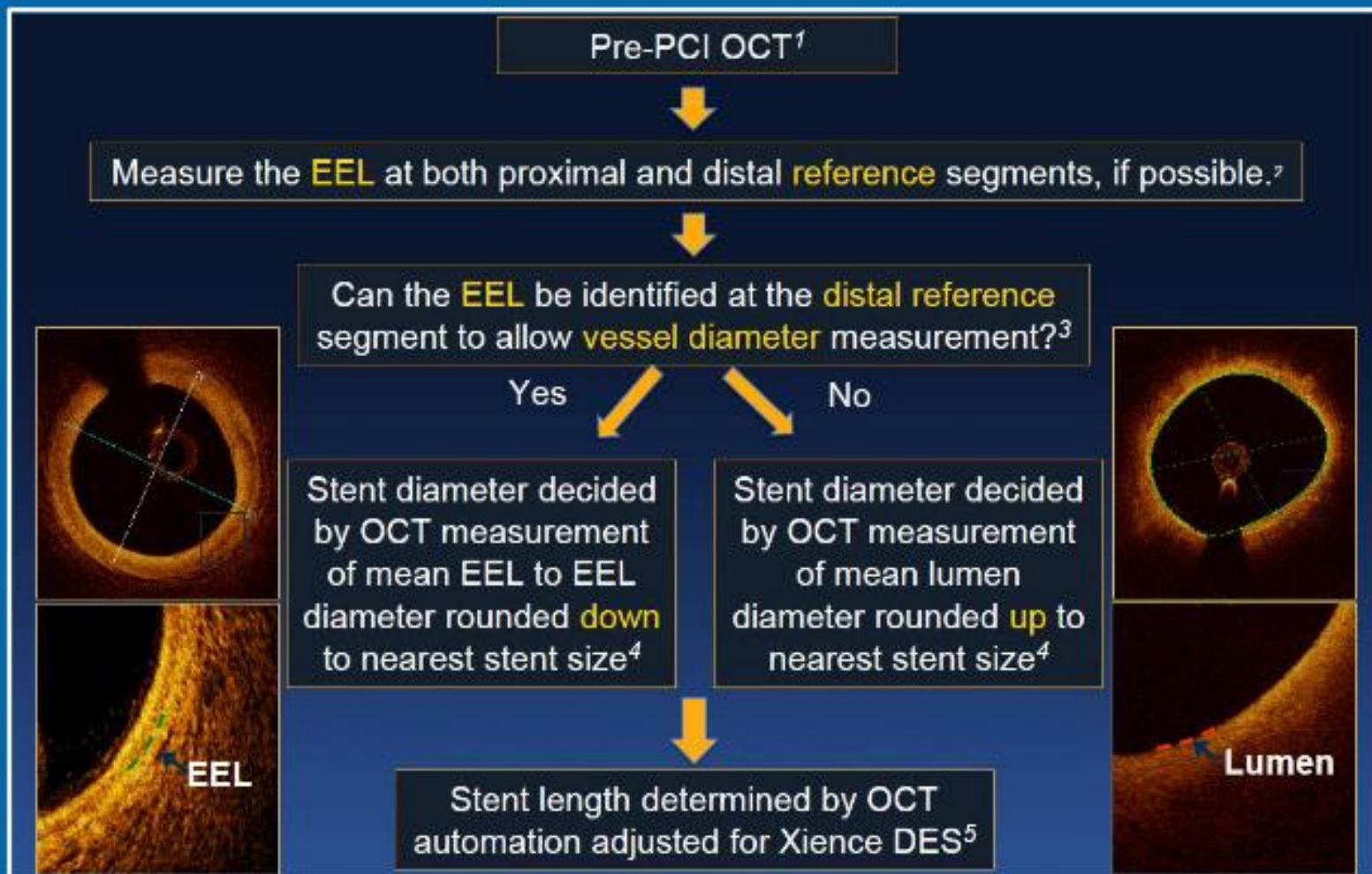
	IVUS	OCT
Severe Calcification	+	+++
CTO	+++	+
LMCA	+++	+
Ostial Disease	+++	+
Advanced CKD	+++	+



Intravascular Imaging Guided-PCI: Practical Strategy



OCT Stent Sizing Algorithm



IVUS or OCT: ? Safe

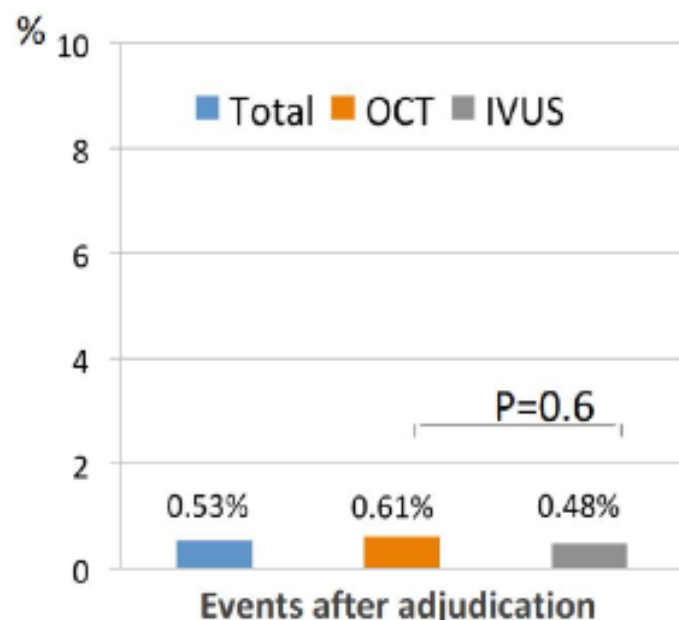


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Safety of optical coherence tomography in daily practice: a comparison with intravascular ultrasound

Johannes N. van der Sijde¹, Antonios Karanasos¹, Nienke S. van Ditzhuijzen¹,

3618 consecutive coronary imaging procedures: MACE 0%



Invasive imaging complications after adjudication

	OCT	IVUS	P-value
Transient ST-elevation	3 (0.26)	2 (0.08)	0.2
Bradycardia	2 (0.18)	1 (0.04)	0.2
Coronary spasm	1 (0.09)	1 (0.04)	0.6
Thrombus formation	1 (0.09)	4 (0.16)	0.6
Dissection	0 (0.00)	3 (0.12)	0.2
Stent deformation	0 (0.00)	1 (0.04)	0.5
Major adverse events	0 (0.00)	0 (0.00)	NA

Values in n (%).



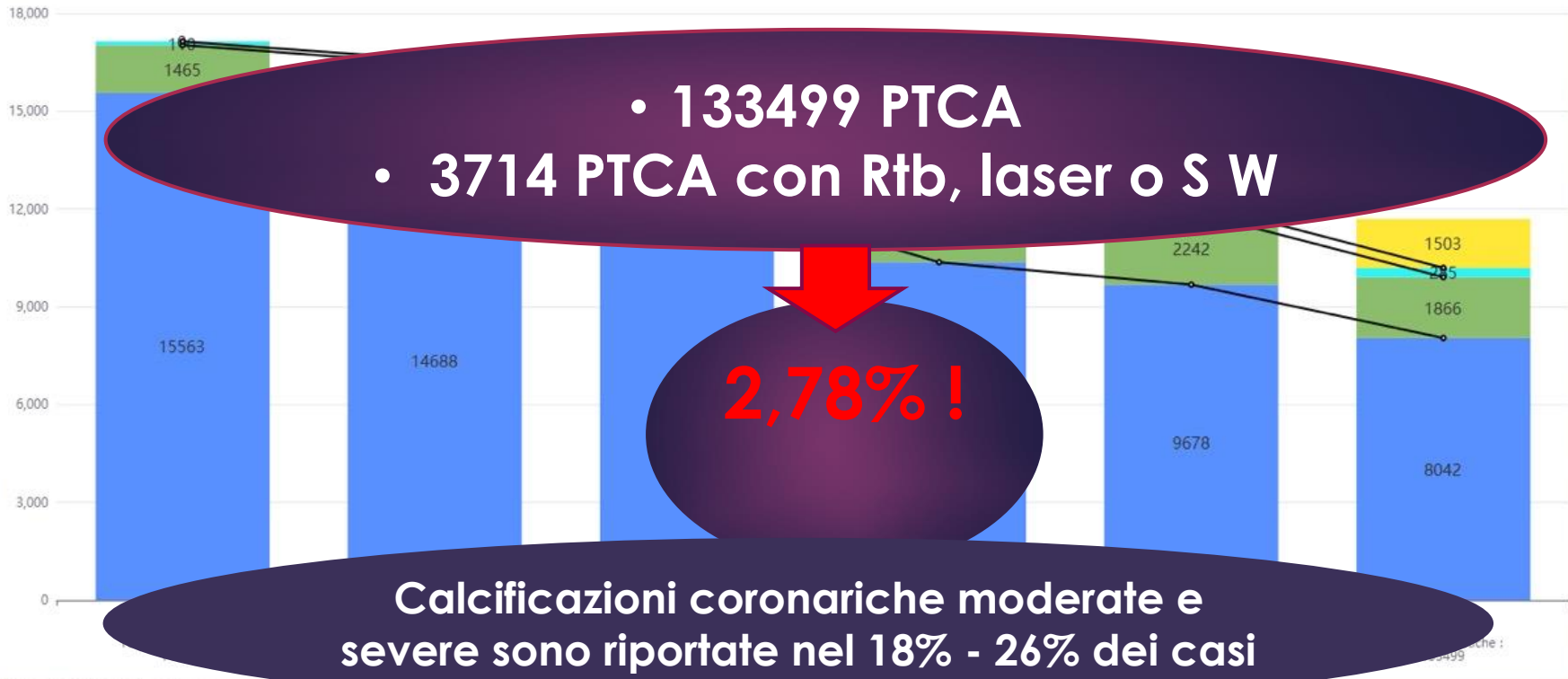




Sistemi di Trombo Aspirazione, rotablator, laser, shock wave*

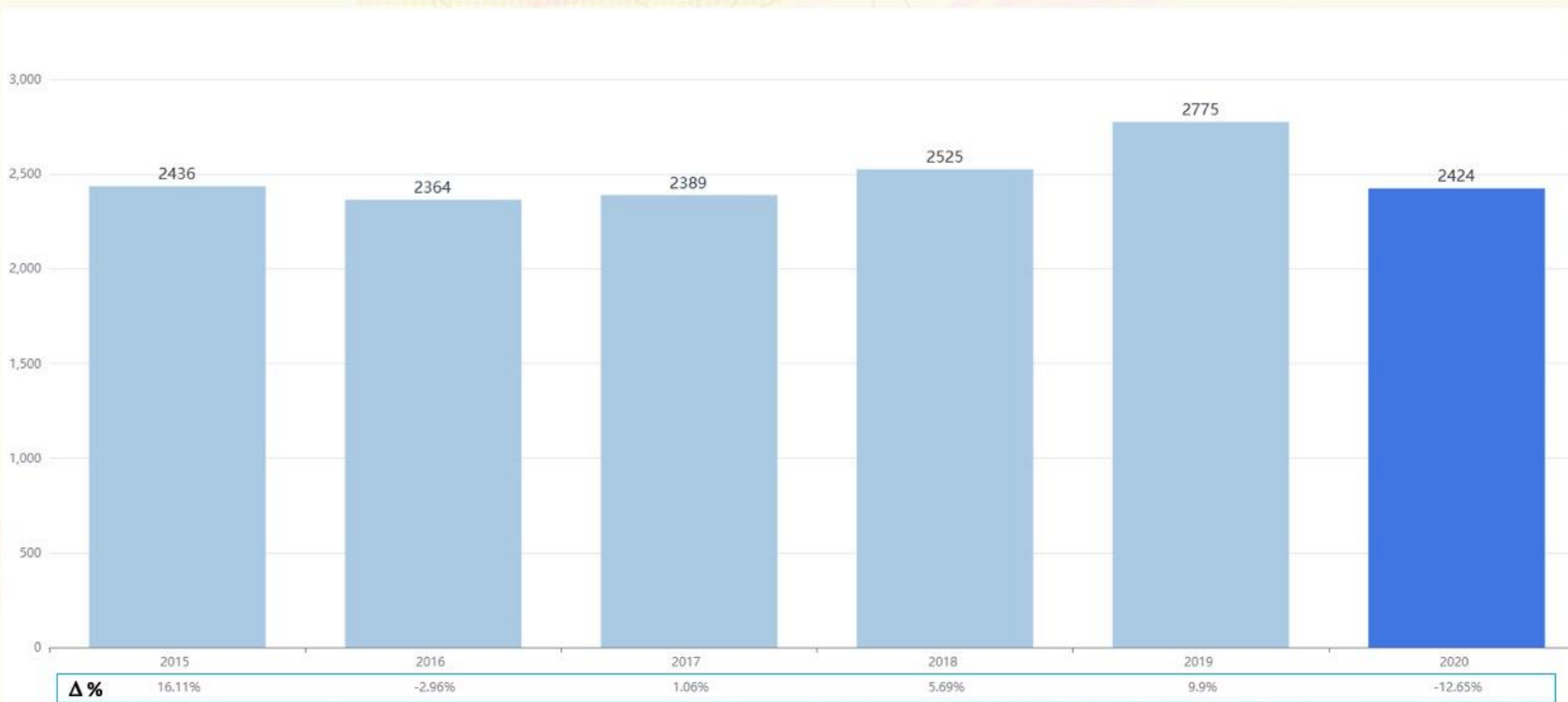
Serie storica Italia

■ Procedure con Sistemi di Aspirazione del Trombo ■ Procedure con Rotablator ■ Procedure con Cateteri Laser ■ Procedure con sistema Shock Wave

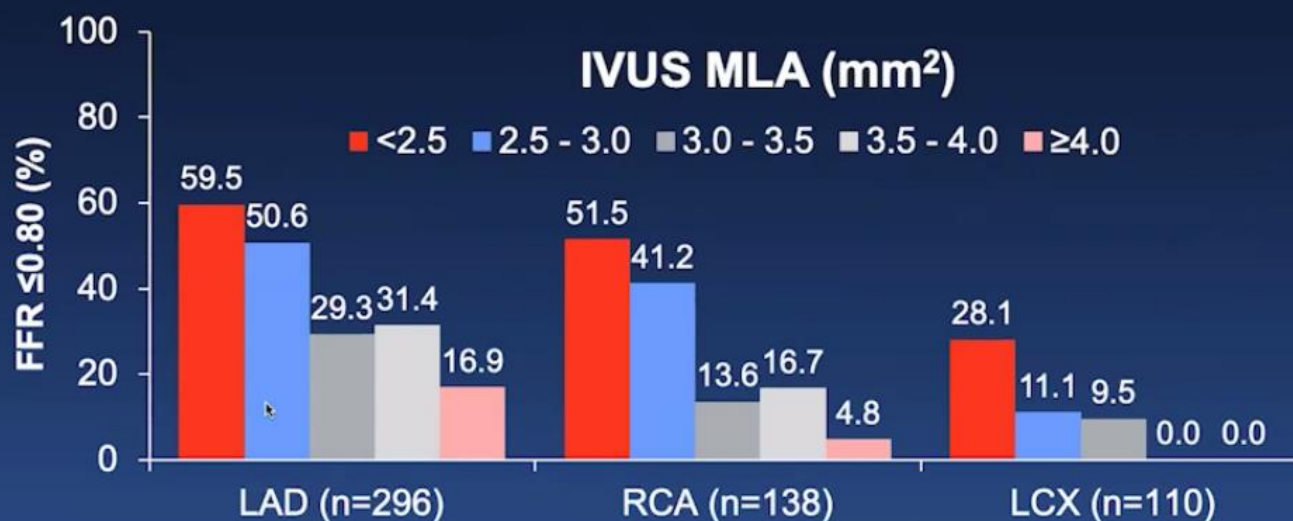


Procedure con OCT

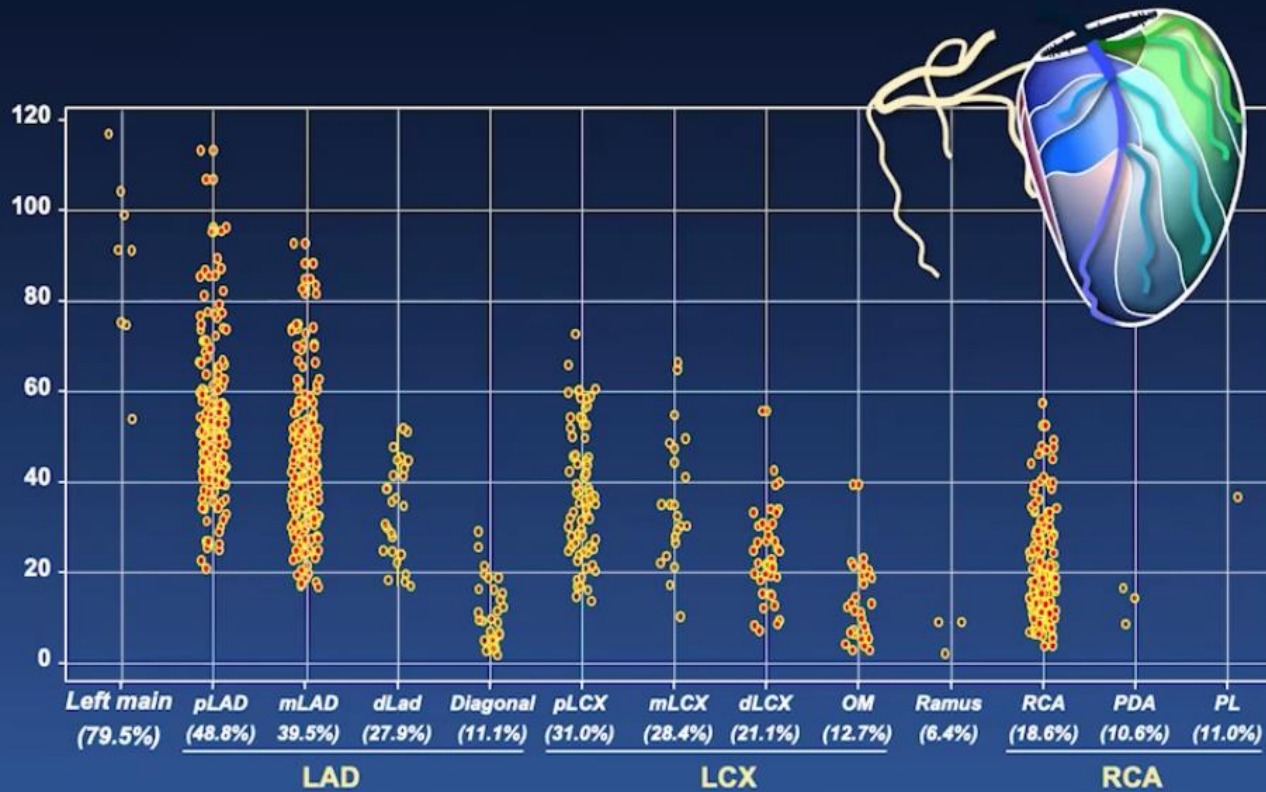
Serie storica Italia



Correlation Between MLA and FFR ≤ 0.80 by Vessel



CCTA-derived fractional myocardial mass (in grams and as % of LV) subtended by the major coronary arteries and their branches in 482 pts







QUANDO ARRIVANO GLI EMODINAMISTI
IN REPARTO:









Grazie



di cuore!!!